What is claimed is:

1. A commutator comprising:

a generally cylindrical dielectric body; and

a plurality of commutator segments arranged along an outer peripheral surface of the dielectric body, wherein:

each commutator segment includes at least one ridge, which extends in a direction generally parallel to an axial direction of the commutator and radially inwardly projects into the dielectric body to secure the commutator segment relative to the dielectric body;

each ridge includes a plurality of high projecting portions and a plurality of low projecting portions, wherein each high projecting portion has a projecting length, which is measured from a base end of the ridge in a projecting direction of the ridge and is longer than that of each low projecting portion;

the high projecting portions and the low projecting portions of each ridge are alternately arranged in a longitudinal direction of the ridge; and

at least one of the high projecting portions of each ridge includes:

at least one groove that is obliquely angled relative to the longitudinal direction of the ridge; and

at least one protrusion that is bound with one of the at least one groove and protrudes in an imaginary plane generally perpendicular to the projecting direction of the ridge.

2. The commutator according to claim 1, wherein at least one of the at least one protrusion of the at least one of the high projecting portions of each ridge protrudes in the longitudinal direction of the corresponding ridge.

3. The commutator according to claim 2, wherein the at least one of the at least one protrusion of the at least one of the high projecting portions of each ridge protrudes over an adjacent one of the low projecting portions of the ridge.

4. The commutator according to claim 1, wherein at least one of the at least one protrusion of the at least one of the high projecting portions of each ridge protrudes in a circumferential direction of the dielectric body.

5. The commutator according to claim 1, wherein at least one of the low projecting portions of each ridge includes at least one protrusion, which protrudes in a circumferential direction of the dielectric body.

6. The commutator according to claim 1, wherein:

the at least one ridge of each commutator segment includes first and second ridges;

each low projecting portion of each of the first and second ridges includes first and second protrusions, which protrude away from each other in a circumferential direction of the dielectric body;

a protruding length of each first protrusion, which is measured in the circumferential direction of the dielectric body, is longer than that of each second protrusion;

each of the first protrusions of the first ridge and a corresponding one of the first protrusions of the second ridge protrude toward each other in the circumferential direction of the dielectric body; and

each of the second protrusions of the first ridge and a corresponding one of the second protrusions of the second ridge protrude away from each other in the circumferential direction of the dielectric body.

7. The commutator according to claim 1, wherein each low projecting portion is recessed such that a bottom of the recessed low projecting portion, which has a deepest depth in the low projecting portion, is elongated in the longitudinal direction of the corresponding ridge.

8. The commutator according to claim 7, wherein the recessed low projecting portion is curved.

9. The commutator according to claim 7, wherein the recessed low projecting portion is V-shaped.

10. The commutator according to claim 1, wherein each low projecting portion is recessed such that a bottom of the recessed low projecting portion, which has a deepest depth in the low

projecting portion, is elongated in a circumferential direction of the dielectric body.

11. The commutator according to claim 10, wherein the recessed low projecting portion is curved.

12. The commutator according to claim 10, wherein the recessed low projecting portion is V-shaped.

13. The commutator according to claim 1, wherein:

each commutator segment further includes a commutator riser; and

each ridge of each commutator segment is spaced a predetermined distance from a base end of the commutator riser.

14. A method for manufacturing a commutator, the method comprising:

providing a plate material that has a plurality of parallel ridges;

intermittently pressing each ridge of the plate material with at least one projecting portion forming punch along a length of the ridge to provide alternately arranged high projecting portions and low projecting portions along the length of the ridge;

pressing at least one of the high projecting portions of each ridge with at least one groove forming punch to form at least one groove, which is obliquely angled relative to a longitudinal

direction of the ridge, in each of the at least one of the high projecting portions in such a manner that formation of the at least one groove results in simultaneous formation of at least one protrusion in each of the at least one of the high projecting portions, wherein each protrusion of the at least one of the high projecting portions protrudes in an imaginary plane generally perpendicular to a projecting direction of the corresponding ridge;

rolling the plate material into a cylindrical shape such that the ridges are placed on an inner peripheral side of the cylindrically rolled plate material;

filling dielectric resin in a liquid phase into a space defined radially inward of the cylindrically rolled plate material; and

cutting and dividing the cylindrically rolled plate material at predetermined angular intervals to form a plurality of commutator segments after solidification of the resin.

15. The method according to claim 14, the intermittently pressing of each ridge with the at least one projecting portion forming punch results in simultaneous formation of at least one protrusion, which protrudes in a direction perpendicular to the longitudinal direction of the ridge, in each low projecting portion.

16. An apparatus for manufacturing a commutator from a plate material, which includes a plurality of parallel ridges, the

apparatus comprising:

at least one projecting portion forming punch, which intermittently presses each ridge of the plate material along a length of the ridge to provide alternately arranged high projecting portions and low projecting portions along the length of the ridge; and

at least one groove forming punch, which presses at least one of the high projecting portions of each ridge to form at least one groove, which is obliquely angled relative to a longitudinal direction of the ridge, in each of the at least one of the high projecting portions in such a manner that formation of the at least one groove results in simultaneous formation of at least one protrusion in each of the at least one of the high projecting portions, wherein each protrusion of the at least one of the high projecting portions protrudes in an imaginary plane generally perpendicular to a projecting direction of the corresponding ridge.

17. The apparatus according to claim 16, wherein the at least one projecting portion forming punch simultaneous forms at least one protrusion, which protrudes in a direction perpendicular to the longitudinal direction of the ridge, in each low projecting portion at the time of intermittently pressing each ridge of the plate material along the length of the ridge.

18. A commutator plate material comprising a plurality of parallel ridges, wherein:

each ridge includes a plurality of high projecting portions and a plurality of low projecting portions, wherein each high projecting portion has a projecting length, which is measured from a base end of the ridge in a projecting direction of the ridge and is longer than that of each low projecting portion;

the high projecting portions and the low projecting portions of each ridge are alternately arranged in a longitudinal direction of the ridge; and

at least one of the high projecting portions of each ridge includes:

at least one groove that is obliquely angled relative to the longitudinal direction of the ridge; and

at least one protrusion that is bound with one of the at least one groove and protrudes in an imaginary plane generally perpendicular to the projecting direction of the ridge.

19. The commutator plate material according to claim 18, wherein at least one of the low projecting portions of each ridge includes at least one protrusion, which protrudes in a direction perpendicular to the longitudinal direction of the ridge.